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DWO: HOUSTON'S SUPERIOR WATER

By

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The City of Houston is a vast program dedicated to providing services to meet the needs of the citizens of Houston and the surrounding areas. The City of Houston consists of departments that are organized and constructed in a specific way so that specific tasks can be carried out based on the procedures, standards and practices within each department. A wide array of departments exists ranging from the Department of Health & Human Services to the Department of Parks & Recreation. The Department of Public Works and Engineering provides technical services to the public by incorporating the concepts of technology and efficiency into its system. These two concepts are the building blocks for the Public Works and Engineering Drinking Water Operations Branch. The objective of this research paper is to investigate various elements that make up the Drinking Water Operations Branch to determine if they are beneficial to the overall goal of the branch, which is the service of providing clean drinking water to the public. Before this can be achieved, a clear understanding of the branch's structure, standards, practices and processes must be defined and explained.

In almost any profession communication, teamwork and professionalism are important factors that can influence the success of a business as well as the size of its customer base. These three concepts blend together naturally from an idealistic perspective. Without communication and teamwork, the productivity of the branch and the department as a whole will suffer. Long Nguyen of the Drinking Water Operations Branch states, "At the Northeast Water Purification Plant, employees take care of each other along with their own responsibilities. We have to provide continuous service everyday for the citizens of Houston so it's important for employees to function as a team and to ask for help when needed...so that the progress of the system will continue with

little or no interruptions" (Nguyen, Long. Personal Interview). Based on Mr. Nguyen's statement, it becomes apparent that communication and teamwork play vital roles in the process of providing services to the public.

Communication and teamwork can dramatically influence every aspect of the Drinking Water Operations Branch from data management to trouble shooting. These two elements can also influence the concepts of time and efficiency. A decrease in time (for providing services to the public) and efficiency can lead to risks for the provider (financial and customer risks) and the customer (a decrease in service for a product). Professionalism is just as important as communication and teamwork. Professionalism plays a vital role in the water industry and it can have an impact on how the public views the services of the Drinking Water Operations Branch as well as the Department of Public Works and Engineering. For the Engineering, Utilities and Public Works Training Institute, everything that the water provider does is a matter of public relations. Meter readers, operators and all others who work in the water industry meet customers at one time or another. The interaction the public has with personnel makes an impression in the public mind, good or bad (Unit I Basic Water Operations Ch2-2). This provides further evidence of the importance of professionalism. Employees must present themselves in a positive, professional manner at all times. The Engineering, Utilities and Public Works Training Institute states, " Employees should wear proper clothing, teach customers how to read their meter and explain utility policies, standards and processes on a as needed basis...employees should also warn customers of services interruptions and handle all complaints tactfully" (Unit I Basic Water Operations Ch2-2; Ch2-3).

The City of Houston uses various processes, procedures and equipment to provide

clean drinking water to the public. These processes, procedures and equipment play a part in every stage of the drinking water service. The Northeast Water Purification Plant is a conventional filtration plant that draws in 80 mgd of water from Lake Houston. The first stage of the purification process consists of a raw water system. The components of this system are the raw water intake and the raw water pump system. The raw water intake draws in water from the Lake Houston area and sends it to the raw water pump station where water is pumped through a pipe known as a raw water transmission main. A device known as a rapid mix pump mixes a coagulant (ferric sulfate or acidified alum) with the raw water.

After the coagulation process, the water travels to a splitter box system that evenly disperses the water into a set of basins. At the basins the water goes through another rapid mix pump system where the water is directed to a filter system. From here, a device known as a transfer pump sends the water to a UV building where the water undergoes the last stage of purification and disinfection prior to entering a ground storage tank for distribution to the public. These steps provide an overview for a rather complex process. The effectiveness and efficiency of the water purification system depends largely on the equipment and procedures that are used in the system.

Various gas and chemical procedures are used in the water treatment process. William R. Shea of the Northeast Water Purification Plant states, "Chemicals are added for the treatment process and to add aesthetic qualities (taste, odor and color) to the water as well" (Shea, personal interview). Aeration is a procedure that uses oxygen to add flavor to the water. The pre-treatment process also uses chemicals to keep algae, harmful bacteria and byproducts (cancer causing substances) to a minimum. An example would

be the use of hydrogen sulfide used for disinfection. As mentioned previously, coagulant is used. The coagulation process removes organic matter and particles while making the water clearer.

The Northeast Water Purification Plant Operations & Maintenance Manual lists some of the other chemicals used in the water process (>>><<<). Chemicals such as Potassium Permanganate and Powdered Activated Carbon are used for taste and odor control. Carbon Dioxide, Sodium Hydroxide and Lime are used to control the pH level of the water so that it doesn't become too acidic or basic. Substances such as Sodium Hypo chlorite and Ammonium Hydroxide are used to further the disinfection process.

For the treatment process, certain procedures are used to increase the quality of the drinking water. "Flocculation, Sedimentation and Filtration are crucial to the water process. Coagulant Aids, Filter Aids and Flocculation Aids are made from polymers. These aids are added to each procedure (flocculation, coagulation and filtration) in order to increase the water quality tremendously" (Shea, personal interview). Flocculation causes particles or floc in the water to stick together and separate from the water. Sedimentation causes the floc to settle and accumulate at the bottom of the basin. Filtration involves the use of a filter system made of anthracite and sand. This system traps any excess substances or particles while filtering out clean water.

The processes and procedures need control, operation and monitoring. This is where equipment factors enters into the system. Pumps and valves are used to keep the water flowing. As a backup, the valves are used to divert the water through an alternate path in case of system or equipment failure. Other devices are used for monitoring such as analyzers and turbidity meters. Analyzers allow chemists to take samples and analyze

the water quality and composition at its current state. This allows the chemists to determine if too much or too little chemicals are used in the system thus allowing room for adjustments as needed. Turbidity Meters measure how clear the water is based on the amount of substances or particles that exist in the water. Turbidity Meters allow workers to compare the water at various stages of the water process. Flow Meters determine the flow rate of the water through the system. These devices are useful for monitoring. They can help workers identify leaks, blocks or failures in the system.

The most important equipment used at the Northeast Water Purification Plant is the Supervisory Control and Data Acquisition system or SCADA system. Long Nguyen states, "The Supervisory Control and Data Acquisition system is a self-running unit that requires minimum manual labor. Without this system, the water treatment process would be complex and difficult. Operation, control and monitoring would become difficult and less efficient due to an increase in faults or failures from human operation or manual control" (Long Nguyen, personal interview). The SCADA system consists of integrated PLCs (programmable logic controllers) and other equipment that are used for control and monitoring by a operator. The SCADA system allows the operator to make changes and adjustments so that the water treatment process can progress under normal operating conditions. In a sense, the SCADA system is the "brains" of the Northeast Water Purification Plant.

The process of providing water for public and business use consists of many stages from the intake of raw water to the distribution of the finished water. There are certain rules, regulations and safety requirements that go along with this process. The Unit I Basic Water Operations Handbook states, "water utility operators must notify the

proper authorities of changes in the water source and the water quality along with any potential substances or components that are hazardous to one's health" (Unit I Basic Water Works Operations 3-6). This provides added security and reliability to insure that the cleanest drinking water is produced for the public.

Record keeping is an important part of the water process. Records on future expansion of a water facility as well as the equipment are often used. Records on chemical use, pumping, and the cleaning of storage tanks and equipment are some examples. All Texas public water systems are required to compose a monthly report with data based on these on other records (Unit I Basic Water Works Operation 3-7).

In the water process various chemicals, gases and substances are used in the treatment stages. These chemicals and substances have pH levels (acidic or basic nature) and risk factors that pose as potential health hazards. The City of Houston has taken steps to meet and surpass the government rules and regulations for chemical and substance usage in the water process. The Environmental Protection Agency (EPA) standard for maximum contaminate levels of chemicals used in the water is .3 NTU (Nephelometric Turbidity Unit). The City of Houston standard is .1 NTU or less. Other maximum contaminate levels include Iron with .3 mg/L level, Chlorite with 1 mg/L level and Manganese with a >05 mg/L level (Shea, Personal Interview). Chemicals are grouped by their characteristics and risk factors. Chemicals, substances and gases that pose an immediate danger or permanent danger have primary contaminate levels. Chemicals, substances and gases that don't pose immediate or permanent danger have secondary contaminate levels. With secondary substances, there are very little if any risk factors. However substances with secondary contaminate levels often have unpleasant aesthetic

qualities such as taste, odor and color. Once water enters the treatment process, testing occurs on a continuous basis. The City of Houston consistently sets safety rules and regulations for acceptable chemical levels. This approach allows the City of Houston to produce the best quality water possible by using strict standards that surpass even the EPA standards and regulations.

The Drinking Water Operations Branch consists of different areas that contribute in different ways to the objective of the branch. Some areas gather and manage data through a database system while other areas troubleshoot and maintain equipment. Garland Beshears is the Maintenance Section Chief for the Department of Public Works & Engineering's Northeast Water Purification Plant. Mr. Beshears's main duty is to oversea mechanical problems and repairs in the Northeast Water Purification Plant. Mr. Beshears is also responsible for providing MSDS or Material Safety Data Sheets for the operations crew. Mr. Beshears states, "Sometimes I take it upon myself to do jobs outside of my area such as ordering equipment for the plant and filling out work order forms. It's important to have the right tools, equipment and materials in order to keep the plant operating under normal conditions" (Beshears, Personal Interview). Mr. Beshears's statements provide some insight on the objective of the operations area as it relates to the Drinking Water Operations Branch's objective of providing clean water for the Houston area. Without the proper equipment, maintenance and materials, achieving this objective would be extremely difficult if not virtually impossible. The operations area plays a vital role in the drinking water process. If equipment fails and the SCADA system malfunctions, the operations crew manually inputs data and controls the equipment. The

operations crew is also responsible for repairing equipment due to mechanical wear or other natural occurrences such as raw water particles clogging analyzer tubing or turbidity meter lines.

The WMS or Work Management System is responsible for collecting and managing data. Employees in this area are required to record data and take pictures of tag numbers. The WMS employees are also responsible for obtaining and recording the specifications and physical conditions of the equipment used at various plants and well sites. This system allows the Drinking Water Operations Branch to keep up with each plant and well site. It also serves as a means for preventive maintenance. The Work Management System can report faulty equipment or equipment that appears to have a decrease in performance and reliability. As a result, the progress of water distribution and water treatment will continue to operate under normal conditions. The Work Management System also generates detailed reports and equipment lists for future expansion of the plants, the current operating conditions of the plants, and the equipment that is needed to run the plants. Both the operations crew and WMS team contribute to the goal of the Drinking Water Operations Branch albeit different ways. This ensures that clean water is provided to Houston and the surrounding areas on a continuous basis

The citizens of Houston and the surrounding areas rely on the Drinking Water Operations Branch on a daily basis. After all, water is an essential part of life that people use on a continuous basis. The Drinking Water Operations Branch provides over 146 billion gallons of water per year. The Drinking Water Operations Branch contributes to the public by providing the best drinking water possible. This is accomplished by using the best resources and staff available.

The processes, procedures and equipment use the latest in technology to ensure that water is provided in an efficient and reliable manner. The safety rules and regulations set by the City of Houston provides proof that customer satisfaction and safety comes first. The communication, teamwork and professionalism of the employees also contribute to customer satisfaction. The various areas within the Drinking Water Operations Branch carry out different roles to ensure that the progress of the water system is consistently progressing and flowing clean water to its intended destinations. From this, it becomes clear that the goal of the Drinking Water Operations Branch is "to be the nation's leading public utility, champion for the environment, providing reliable service of exceptional quality to the most satisfied customers in the nation" (Jeff Taylor).